

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US98/16974

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : B23P 17/00; B02C 7/04, 1/10
 US CL : 29/415, 416, 425; 241/261.2, 261.3, 298

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 29/415, 416, 425; 241/261.2, 261.3, 298

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

search terms: blades, spacers, refiner filling

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,740,972 A (MATTHEW) 21 APRIL 1998, See column 4, lines 19-51, and Figure 1.	8
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Y	see Figure 1.	9, 10
X	US 5,383,617 A (DEUCHARS) 24 JANUARY 1995, See column 4, lines 20-45, and Figures 1 and 2.	8
—		—
Y	see especially Figure 2.	9
X	US 3,910,511 A (LEIDER ET AL.) 07 OCTOBER 1975, See column 4, lines 32-53 and column 6, lines 25-38. see also Figures 1 and 6.	8

<input checked="" type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input type="checkbox"/>	See patent family annex.
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* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 07 MAY 1999	Date of mailing of the international search report 25 MAY 1999
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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer TOM HUGHES Telephone No. (703) 308-1806	<i>Sheila Veney</i> Paralegal Specialist Technology Center 3700
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PCT/US98/16974

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,249,734 A (PILAO) 05 OCTOBER 1993, See column 5, lines 30-38. see also Figures 2 and 3.	8
Y	US 3,473,745 A (SHOOK, JR., ET AL.) 21 OCTOBER 1969, See column 2, lines 38-49. See also see Figures 1 and 2.	8-10
A	US 4,023,737 A (LEIDER ET AL.) 17 MAY 1977, See document.	1-10
A	US 4,813,621 A (KLEINHANS) 21 MARCH 1989, See document.	1-10
A	US 3,040,997 A (BORDEN) 26 JUNE 1962, See document.	1-10

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BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

- I. Claims 1-8, drawn to a refiner filling.
- II. Claims 9 and 10, drawn to blades and spacers.

The inventions listed as Groups I and II do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Group I requires the special technical feature of a segment edge lying along a pumping angle. Group II requires the special technical feature of at least one of a second blade having a predetermined length and having a notch therethrough. Since the special technical feature of the Group I invention is not present in the Group II invention as claimed and the special technical feature of the Group II invention is not present in the Group I invention as claimed, unity of invention is lacking.

~~REPLACED BY
APR 24 1997~~

A method of manufacture of a refiner filling having blades and spacers comprising the steps of:

establishing the defining margins of an active refining zone of the refiner;

5 *selecting a pumping angle of the refiner filling;*

subdividing the filling into equal segments with each segment having spaced edges extending between the defining margins, and with one segment edge lying along a pumping angle;

subdividing the segments into bar set clusters with each cluster having 10 an edge defining a pumping angle;

combining the outline of two clusters to form a bar set envelope;

assembling blades and spacers in the bar set envelope;

severing the bar set into two equal bar set clusters;

assembling clusters to form a refiner segment; and

15 *assembling segments to form a refiner filling.*

2. A method of manufacture of a refiner filling having blades and spacers comprising the steps of:

establishing the outer and inner perimeters of an active refining zone 20 of the refiner;

selecting a pumping angle off-set from a radial of the refiner filling;

subdividing the filling into equal segments with each segment having spaced edges extending between inner and outer perimeters, and with one segment edge lying along a pumping angle off-set from a radial;

25 *subdividing the segments into bar set clusters with each cluster having an edge defining a pumping angle;*

combining the outline of two clusters to form a bar set envelope;

assembling blades and spacers in the bar set envelope;

severing the bar set into two equal bar set clusters;

30 *assembling clusters to form a refiner segment; and*

assembling segments to form a refiner filling.

3. A method according to claim 2 in which the refiner filling is a disc of 360° , the segments each having degree value as an integer 360° , and the pumping angle being evenly divisible into 360° , and into the degree value of the segments.

5 4. A bar set preform for a refiner filling having a selected pumping angle, the preform comprising a perimeter outline defining a parallelogram, the side edges of the parallelogram offset by a value equal to the pumping angle, an array of blades and spacers arranged alternately to substantially fill the area of the parallelogram, the blades and spacers affixed to each other, and a cut line across 10 the parallelogram for dividing the bar set into two pieces with each piece having an edge corresponding to the pumping angle.

5. A bar set preform as defined in claim 4 in which the blades are prenotched along the cut line.

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6. A bar set preform as defined in claim 5 in which the inner end of each blade is tapered.

7. A refiner filling comprising an active refining zone of bars and 20 spacers fabricated by:

establishing the outer and inner perimeters of an active refining zone of the refiner;

selecting a pumping angle off-set from a radial of the refiner filling;

subdividing the filler into equal segments with each segment having 25 spaced edges extending between inner and outer perimeters, and with one segment edge lying along a pumping angle off-set;

subdividing the segments into bar set clusters with each cluster having an edge defining a pumping angle;

combining the outline of two clusters to form a bar set envelope;

30 assembling blades and spacers in the bar set envelope;

severing the bar set into two equal bar set clusters;

assembling clusters into a refiner segment; and

assembling segments into a refiner filing.

8. A bar set cluster for a refiner filling having a radius, outer and inner perimeters and a selected pumping angle, the cluster margins being defined by 5 spaced side edges lying along the pumping angle, an outer margin defined by a chord of the outer perimeter between spaced side edges, and an inner margin defined by a line parallel to the chord and intersecting both the inner perimeter and one side edge, and an array of blades and spacers occupying substantially the entire area defined by the cluster margins, and each blade lying along the pumping 10 angle.

9. Blades and spacers for a refiner filling comprising at least one of a first blade of predetermined length having a tapered end, at least one of a second blade having said predetermined length and having a notch through which the blade 15 is cut into blade segments, said notch being defined by tapered shoulders so that each blade segment has a tapered end, and a spacer placed between adjacent blades defining a groove between the blades.

10. Blades and spacers for a refiner filling comprising at least one of a 20 first blade of predetermined length having a tapered end, at least one of a second blade having said predetermined length and having an end notch defined by a tapered shoulder through which end notch the blade is cut, at least one of a third blade having said predetermined length and having a center notch through which the blade is cut into blade segments, said end and center notches being defined by 25 tapered shoulders so that each blade segment has a tapered end, and a spacer placed between adjacent blades defining a groove between the blades.